CS575/475
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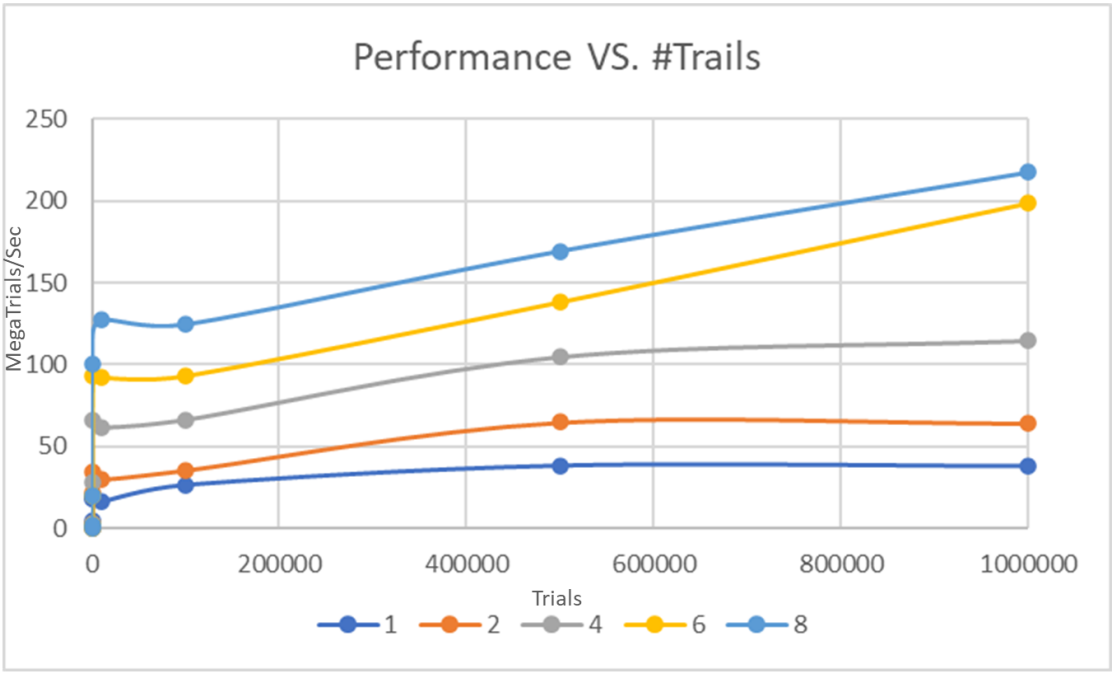
Project #1
OpenMP: Monte Carlo Simulation

Machine: rabbit
NUMTIMES: 20

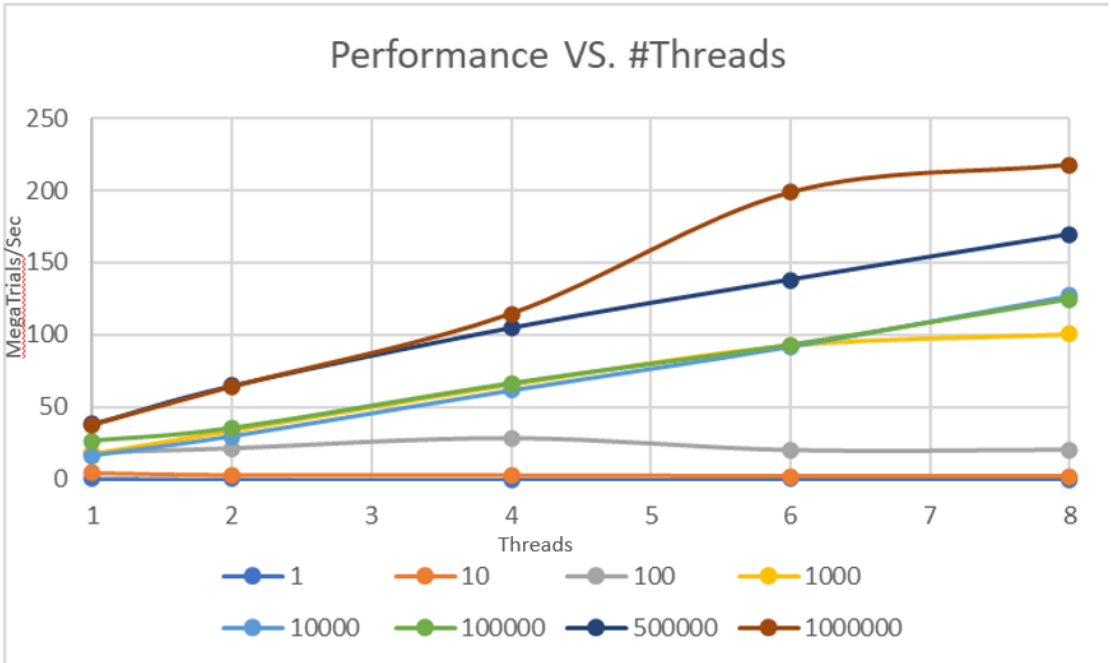
Threads	Trials	Probability	MegaTrials/Sec
1	1	0	0.6
1	10	40	4.7
1	100	55	18.32
1	1000	56.6	18.07
1	10000	57.02	16.19
1	100000	56.79	26.36
1	500000	57.01	38.1
1	1000000	56.91	37.79
2	1	0	0.35
2	10	30	2.94
2	100	53	21.27
2	1000	57	34.18
2	10000	56.47	29.73
2	100000	56.85	35.31
2	500000	56.94	64.65
2	1000000	57.05	64.1
4	1	0	0.23
4	10	70	2.79
4	100	61	28.17
4	1000	58.1	65.96
4	10000	57.24	61.54
4	100000	56.95	66.31
4	500000	56.9	104.75
4	1000000	56.92	114.61
6	1	0	0.25
6	10	50	2.21

6	100	51	20.01
6	1000	56.9	92.86
6	10000	55.94	91.98
6	100000	56.85	92.94
6	500000	56.97	138.1
6	1000000	57.04	198.49
8	1	100	0.23
8	10	50	2.18
8	100	54	20.23
8	1000	57.3	100.63
8	10000	56.9	127.27
8	100000	57.26	124.51
8	500000	57.02	169.36
8	1000000	57.04	217.54

	1	2	4	6	8
1	0.6	0.35	0.23	0.25	0.23
10	4.7	2.94	2.79	2.21	2.18
100	18.32	21.27	28.17	20.01	20.23
1000	18.07	34.18	65.96	92.86	100.63
10000	16.19	29.73	61.54	91.98	127.27
100000	26.36	35.31	66.31	92.94	124.51
500000	38.1	64.65	104.75	138.1	169.36
1000000	37.79	64.1	114.61	198.49	217.54



Graph1



Graph2

Good estimate of the Probability

$$\frac{56.91 + 57.05 + 56.92 + 57.04 + 57.04}{5} = 56.992\%$$

Estimate of Speedup (max number of trials 1000000)

Speedup = (Peak Performance 8 threads) / (Peak performance 1 thread)

Speedup $= \frac{Peak\ Performance\ n\ threads}{Peak\ performance\ 1\ thread}$

Speedup from 1 threads to 2 threads = $\frac{64.1}{37.79}$ = 1.71

Speedup from 1 threads to 4 threads = $\frac{114.61}{37.79}$ = 3.03

Speedup from 1 threads to 6 threads = $\frac{198.49}{37.79}$ = 5.25

Speedup from 1 threads to 8 threads = $\frac{217.54}{37.79}$ = 5.76

Estimate of Fp:

$$Fp = \frac{n}{n-1} \times (1 - (\frac{1}{S}))$$

$$Fp = \frac{2}{1} \times (1 - (\frac{1}{1.71})) = 0.821$$

$$Fp = \frac{4}{3} \times (1 - (\frac{1}{3.03})) = 0.894$$

$$Fp = \frac{6}{5} \times (1 - (\frac{1}{5.25})) = 0.972$$

$$Fp = \frac{8}{7} \times (1 - (\frac{1}{5.76})) = 0.944$$

Given this Parallel Fraction, what would the maximum speedup be if you could throw hundreds of cores at it?

$$maxSpeedup = \frac{1}{1 - Fp}$$

$$maxSpeedup\ 1\ to\ 2 = \frac{1}{1 - 0.821} = 5.59$$

$$maxSpeedup\ 1\ to\ 4 = \frac{1}{1 - 0.894} = 9.43$$

$$maxSpeedup\ 1\ to\ 6 = \frac{1}{1 - 0.972} = 35.71$$

$$maxSpeedup\ 1\ to\ 8 = \frac{1}{1 - 0.944} = 17.86$$

Therefore, when hundreds of cores are available, the maximum speedup that can be expected ranges from approximately 5.59 to 35.71.

Commentary

The line in graph 1 fluctuates at the beginning, that is, there are peaks and troughs in the rising process. This may indicate that the system encounters a performance bottleneck or resource competition at some points, resulting in a temporary decline in performance. And the line levels off after reaching a certain point, which indicates that the system has reached the upper limit of its processing capabilities.

In graph 2, the line rises and slows down or decreases after a certain number of threads. This may mean that adding more threads has less impact on performance, or even causes performance loss due to the overhead of context switching. The lines have large fluctuations at certain points in the middle, which reflects uneven load distribution or that the system is having problems adjusting and optimizing load distribution.